EPA Comments on Technical Memorandum: Comprehensive Synopsis of Approaches and Methods, Ecological Risk Assessment
October 1, 2004

General Comments:

Estimates of Dietary Intake:

The Comprehensive ERA TM presents dietary assumptions for fish. These dietary assumptions will be used to estimate exposure of fish to metabolized or regulated chemicals such as PAHs and metals. For example, the northern pikeminnow is assumed to feed on 30% crayfish, 47.6% sculpin, 7% juvenile Chinook salmon and 3.9% each of the northern pikeminnow, carp, peamouth and largescale sucker. These assumptions are based on limited information, and it is unclear if this level of precision will result in a higher degree of confidence in the risk estimates, or whether this level of precision will ultimately increase the uncertainty in the risk estimates. In the absence of solid, site specific information, diet composition should be based on conservative assumptions. In addition, sensitivity and uncertainty analysis should be presented to understand how altering fish composition by certain compositions and percentages alters the final exposure concentration. Relevant ranges of potential diet concentrations should be provided.

Based on the dietary assumptions presented in the Comprehensive ERA TM, the diet of many receptors will be represented primarily by crayfish and clams collected from the initial study area (ISA). For example, diet for the peamouth is estimated primarily with crayfish tissue (45%) and clam tissue (45%), with 5% sculpin tissue and 5% juvenile Chinook salmon tissue making up the remainder. This is not necessarily a realistic diet for many receptors. Although crayfish are an important dietary item for species such as smallmouth bass, river otter, and mink, it is unclear whether crayfish accurately represent the year-round diet for other receptors such as sculpin. Furthermore, there is insufficient clam tissue data to utilize clam tissue data for estimating dietary exposure. In addition, juvenile Chinook Salmon are also considered a dietary component for many receptors. This is not appropriate for many species such as sculpin and may under estimate exposure. In some cases, fish are assumed to eat what limited tissue types are currently available whether it is an appropriately conservative estimation of risk or not. In addition, some food types such as insects and Daphnia are not considered. For example, Daphnia are not mentioned at all, in spite of the City of Portland's report that several species, especially juvenile Chinook salmon, feed predominately on this species in Portland Harbor.

This emphasizes a data gap in estimating tissue concentrations of invertebrates, which becomes more apparent when data collected by the Oregon Department of Fish and Wildlife (ODFW) on food items is examined (many feed on insects and invertebrates). ODFW (unpublished data) conducted a study on Willamette River fish that included stomach analysis of fish. The ODFW data should be used to help establish appropriate fish diets. During the years 2002 and 2003, ODFW obtained 121 diet samples from fish larger than 200mm including walleye, northern pikeminnow, smallmouth bass, and largemouth bass. Many fish stomachs were empty, with only 47 fish (or 39%) containing food items. Walleye samples contained the highest occurrence of food items (71.4%), followed by largemouth bass (62.5%), northern pikeminnow (35%) and smallmouth bass (32.6%). The results indicate that by ***wet weight,*** walleye and smallmouth bass consumed primarily fish, and that northern pikeminnow and largemouth bass consumed primarily crayfish. All identifiable prey fish were sculpin; only one juvenile salmonid was recovered from a smallmouth bass stomach. By ***count*** (enumeration only), crayfish were the most frequently occurring food item in northern pikeminnow, smallmouth bass, and largemouth bass. For smaller fish, the diet composition was a little different. In addition, there may be seasonal changes dietary composition. For example, regarding the total proportion of crayfish versus fish prey sources for all predators suggests that fish make up the highest proportional wet weight of food items in winter and spring, while crayfish make up the highest proportional wet weight in summer and autumn. Stomach content information from the ODFW study is attached.

Given the uncertainties outlined above, dietary models to evaluate risk should be used in conjunction with other methods for evaluating the risk of PAHs and metals to fish. These include tissue residue values which estimate effects using body burdens. Although assessing body burdens of metals can be problematic due to numerous processes that control metal uptake, depuration, and distribution, body burdens should be used as an additional line of evidence in the risk assessment. These relationships may be no less reliable than simple concentration-response relationships for metal concentrations in water. Body burdens of effect are presented in many of the EPA water quality criteria documents, the Environmental Residue-Effect Database, and in Jarvinen and Ankley (1999). The biotic ligand model should be also be evaluated for use, as well as comparison to ambient water concentrations (total and dissolved). Other approaches to reducing uncertainty associated with estimating dietary exposure include the collection of additional benthic tissue data such as clams, evaluating exposure in organisms to some contaminants using biomarkers, modeling the concentration of some food items such as insects and invertebrates and/or deployment of caged organisms for in-situ testing.

Central Tendencies vs. Individual Composites:

Composite fish samples collected from the ISA are an estimate of the average concentration. As a result, both individual composite data as well as averages of composites should be used to estimate risk. Although the larger species such as peamouth, sucker, carp, and pikeminnow may range the entire ISA, individual composite samples should be uses to assess risk to the fish themselves. Specifies such as smallmouth bass and sculpin were selected in part due to their small home ranges. As a result, each composite should be evaluated individually to estimate localized risk. Average composite data should be use to evaluate the risk to predators with large home ranges.

Allometric Equations:

Allometric equations are used for every species evaluated in this risk assessment, regardless if empirical data exists. For organisms where no empirical data or surrogate exists, these equations may be appropriate. However, empirical data should be used first if available because this information is the most receptor specific. If allometric equations are to be used, food consumption must be converted to kilograms of fresh weight by adding the water content of the food.

Assessing Risk from Multiple Contaminants and Media:

The Comprehensive ERA TM does not describe how the effects of multiple contaminants and individual or multiple contaminants within different media will be addressed. Further discussion between EPA and the LWG is required to determine how the effects of multiple contaminants and individual or multiple contaminants within different media will be addressed.

Screening Levels:

The document repeatedly refers to "more realistic" exposure scenarios than those used in screening. Screening levels are not unrealistic; they are conservative. Replace this wording throughout with "less conservative".

Specific Comments:

Page 5, Section 2.5: The Comprehensive ERA TM states that the benthic invertebrate community will be assessed using a weight of evidence approach. This approach should be clarified. As stated in our comments on the Benthic Assessment Approach TM, the primary line of evidence for evaluating risks to the benthic community is the use of bioassays and the predictive model. However, other lines of evidence should also be considered.

Page 6, Section 2.2.4: The Comprehensive ERA TM states that amphibians will act as a surrogate for reptile populations. It is unclear whether this is an appropriate assumption. Because reptiles will not be assessed directly, the Comprehensive ERA TM should be revised to state that it is assumed that an assessment of amphibians will be protective of reptiles. The text should be changed to reflect this assumption (i.e., and remove the term surrogate), and the assumption should be reviewed in the uncertainty section. Also, it should be noted that both the western pond turtle (*Clemmys marmorata*) and painted turtle (*Chyrsemys picta)* are listed as critical on the Oregon Sensitive Species list. Both these species could use the ISA, and it is very likely that the painted turtle is not uncommon in the ISA.

Page 6, Section 2.2.5: It should be stated clearly here that risk assessment parameters will be based on protection of birds at the individual level for species of special concern, and when evaluating receptor surrogates that may be representing a species of special concern. For example, the American peregrine falcon (*Falco peregrinus anatum)* is still listed as an endangered species on the Oregon List of Threatened and Endangered Fish and Wildlife species and is present in the ISA. Therefore, the falcon is a species of special concern and like the bald eagle should be assessed at the individual level. Because the falcon was not selected as a representative receptor in the ISA, the appropriate representative bird receptor used as surrogate for the falcon (based on feeding groups) must be evaluated in the risk assessment at the individual level, and site specific parameters attributed to the falcon must be represented in the model to be protective of peregrine falcons. The text should be revised to reflect this concept.

Page 7, Section 2.2.5, Birds: The spotted sandpiper is listed as a surrogate for the Herbivore/omnivore feeding guild. This species' diet consists of insects (flies, grasshoppers, crickets, insect larvae, and beetles), small crustaceans, mollusks, spiders and small fish (Csuti et al., 1997). Hooded mergansers would make a better representation of this guild, given that they can eat seeds and roots of aquatic plants (will be exposed in areas where aquatic plants are found). The exposure area for the merganser (deeper water) in Portland Harbor is also more representative of an herbivore/omnivore species.

Page 7, Section 2.3, Measures of exposure: Measures of exposure also include measured changes in physiological/biochemical processes within organisms as a result of chemical uptake, and also could include evaluating chemical metabolites such as fluorescent aromatic hydrocarbons in fish bile. As stated in Table 2-2, potential exposure through diet and/or biomarker analysis may be utilized if there are links to effects on survival, growth and reproduction. The text should be changed to reflect these types of measures of exposure in addition to discussions of contaminant concentrations in sediment, surface water, groundwater and/or biota. This section should be revised to clearly state what measures of exposure are. In addition, the Comprehensive ERA TM should discuss the concept of bioavailability and how it may affect exposure.

Pages 8 and 9, Section 2.3, Measures of ecological effects: The statement "at or below which statistically insignificant proportion of an exposed population may exhibit adverse effects due to exposure" should be clarified. It is unclear whether this statement means that the value is below a number which a measured effect is no longer consistently or reliably expressed, or whether it means that it is a number which is considered to have a measurable effect on some individuals of a tested population, but the number represents an insignificant portion of the test population. If it is the latter, it is also unclear how this determination will be made.

Page 11, Section 3.1: It is unclear if the historical data discussed here meet "QA2" level quality assurance. As stated in Section 4.1 of the Programmatic Work Plan, "Only Category 1 data that have had an EPA-approved level of data validation, comparable to Washington State Department of Ecology's "QA2" Evaluation, will be used for human health or ecological risk assessments." Sections 3.1.1, 3.1.2, 3.1.3 and 3.1.4 should instead describe what samples meet the QA2 level and are appropriate for use in the risk assessment.

Page 12, Section 3.1.2: Most of the historic surface water samples identified in this section and Figure 3-2 were lipid bag samples collected as part of the McCormick and Baxter investigation. It is unclear how this data will be used in the ecological risk assessment or even whether it is appropriate to be used given that a sediment cap is currently being constructed at the McCormick and Baxter site.

3.2.2 Tissue Data, pg.13, Footnote 6, and pg. 73, Footnote b and c, As EPA has commented previously, Carp and other human health fish tissue will be compared to the ecological fish TRVs as a check on our receptor assumptions. This should be done in the PRE.

Page 13, Section 3.2.2: The 3rd sentence discusses proposals to collect sturgeon and Pacific lamprey ammocoetes in Rounds 2 or 3. EPA has commented previously that additional benthic tissue may have to be collected during these rounds as well. Furthermore, EPA believes that the ODHS sturgeon data should be used as part of the baseline risk assessment.

Page 15, Section 3.5.2: As stated in EPA's comments on the Preliminary Risk Evaluation

Approach Technical Memorandum, the risk from all dioxin-like contaminants as a whole (i.e., dioxin *and* dioxin-like PCBs) should be evaluated in addition to evaluating the risk associated with dioxins and dioxin-like PCB congeners separately.

Page 18, Section 4.0: The first full sentence states that spatial analysis will not be used for the tissue-residue exposure estimation data due to mobility of organisms. However, spatial data could be used to represent clams, crayfish, and possibly sculpin. The Comprehensive ERA TM should be revised to state how spatial analysis would be used to evaluate these groups.

Page 18, Section 4.1: It should be noted that the revised PRE approach TM is under review by EPA and that the approved methods will be utilized in the PRE.

Page 20, Section 4.1.1., Tissue: Although central tendency concentrations for whole-body tissue data may be used in the ecological risk assessment, it should be noted that these samples are already composite samples (representing an average concentration). As a result, composite samples should also be looked at individually to develop an understanding of the spatial variability of risk at the site. Each composite sample should be compared to the appropriate TRV to better understand the nature of risk at the site.

Page 21, Section 4.1.3.3: EPA has commented previously that benthic tissue chemistry data is a major data gap for the site because crayfish are not necessarily representative of the benthic community and because the clam data is too limited to be useful.

Page 23, Section 4.1.4.2: EPA commented on Equation 4-1 in its review of the PRE Approach Technical Memorandum. Sediment ingestion should be incidental (on top of dietary requirements), not a component of the diet. The equation seems to dilute the chemical concentration in the fish by assuming that a percentage of the diet is sediment and a proportion is fish, rather than including sediment as incidental sediment ingestion only. Ingestion of sediment by a fish would not dilute the chemical concentration found in the fish eaten by the predator.

Page 25, Section 4.2: Dietary assumptions for each species should be conservative, such that the most contaminated primary dietary item should make up the majority of the diet. For example, sculpin are assumed to feed on 45% crayfish tissue, 45% clam tissue, 5% sculpin tissue, and 5% juvenile Chinook salmon tissue. It is highly unlikely that sculpin will be feeding on Chinook; insects and other sculpin were found in the majority of sculpin stomach contents. Despite this, crayfish are used to make up a large proportion of their diet. Given the limited data, a conservative prey concentration should be used (e.g. feeding on other sculpin all of the time). Other fish diets have similar problems. Juvenile salmon, which have been found to be feeding predominately on Daphnia in Portland Harbor, are modeled using half crayfish and clam concentrations. A study by Fishman, 1999 (East bank Riverfront Floating Walkway Fish Predation Study), found no juvenile salmonids in the stomachs of piscivorous fish, and stomach contents were dominated by a variable assortment of invertebrates (crayfish, amphipods, insects), and a small percentage of non-salmonid fishes (primarily sculpin). ODFW also found very few juvenile salmonids in the diet of piscivorous fish (one total). Based on this, juvenile salmonid tissue concentrations should be removed from all fish diets compositions.

Page 26, Section 4.2.1.1: It may not be appropriate to assume that crayfish and clams conservatively represent the diet of largescale sucker. The diet of suckers consist of "bottom-ooze" which likely consists of sediment, algae, organic material, bryophytes, detritus, very small bivalves, and other material as indicated in this section. Crayfish are likely not consumed, and Corbicula may only partially represent the diet. Clams may better represent the diet and should be in higher proportion than crayfish, and sediment should likely be higher than 10% (20 to 25%). As mentioned in an earlier comment, the sucker is exposed to the concentration in its prey item and through incidental ingestion of sediment. The sediment incidentally ingested would not dilute the concentration in the prey item consumed by the sucker, so saying prey tissue represents 90% and sediment 10% may not be appropriate.

Page 28, Section 4.2.1.4: The percentage of sculpin in the diet should be increased, and likely the amount of clams/crayfish/salmon decreased. The sculpin were collected in part to represent the small prey fish (e.g., minnow) size range, which are an important component of the diet of many fish including peamouth. Sculpin represent the small fish group in the ISA much better than salmon or invertebrate species.

Page 31, Section 4.2.2.1: Risk based endpoints for spotted sandpiper should be protective of hatchlings and juveniles which are present in the ISA. If no data are available for these life stages, then safety factors should be used to better protect young birds.

Page 32, Section 4.2.2.1, Site use factor: A site use factor (SUF) of one should be used for the spotted sandpiper. Spotted sandpipers can be found in the ISA year-round and breed in the ISA.

Page 33, Section 4.2.2.2, Diet Composition (prey and sediment ingestion): Hooded mergansers were selected to represent fish-eating water birds in the ISA, such as diving waterfowl, great blue herons, and other species. Juvenile salmon are not likely a large percentage of their diet and should be decreased. A large part of the diet of these birds is small fish, represented by sculpin. Sculpin should represent about 65 to 75% of the diet for these receptors, with clams the next highest percentage and the rest split between salmon and crayfish. Bivalves are an important component in the diet of many waterfowl species, so the diet of the representative receptor should be adjusted to be protective of these species.

Page 35, Section 4.2.2.3, Site use factor: Bald eagles collect the majority of their prey near their nest site during the breeding season, and adults could capture all their prey from the ISA during the breeding season. Prey collected entirely from the ISA could also be fed to young during the hatching and fledging stage. Therefore, a SUF of one shall be used in the assessment unless data collected from the ISA (or nearby) on eagles suggests otherwise.

Page 38, Section 4.2.2.5, Site use factor: The SUF for mink should be one, as mink can feed and breed entirely within the ISA, especially female mink. The same is true for female otters (page 40: Site use factor). Unless data specific to mink and otter habitat used can be defined for these species in the ISA, SUFs used in the risk assessment should be one.

Page 41, Section 4.3: The second to last sentence refers to not delineating exposure areas for prey tissue due to mobility of prey. This should be reconsidered for prey species with low mobility such as clams, crayfish, sculpin and possibly smallmouth bass.

Page 41, Section 4.3, Appendix A, and Table 4-4: Sediment exposure areas and risk assessment areas, and how they are determined, should be discussed and agreed upon in a meeting with LWG, EPA and its partners. In addition, the Habitat Suitability Index (HSI) approach should be reviewed, as HSI values are really only guidance values that can change dramatically for species outside the area the HSI was developed for. It is questionable that HSIs will be valuable in the ISA setting. HSI models emphasize quantitative relationships between key environmental variables and habitat suitability. Like any model, the accuracy of their use is dependent on attention to model assumptions. Some of these models were developed for specific populations and ecological areas within the U.S. In order for these models to be used to evaluate habitat within the Pacific Northwest, consultation with local Fish and Wildlife to verify assumptions in the model are representative of species populations in this area is needed. Because a score in these models does not necessarily preclude a receptor from using an area (many receptors have been observed using "habitat" that would not be explicitly linked to use by that receptor), it is unclear whether use of these models within the risk assessment is appropriate. HSI models should be used with caution to exclude areas of potential exposure, unless physical limitations to habitat use are present.

Page 43, Sections 4.3.3.2 and 4.3.3.3 - White Sturgeon and Sculpin models: The HSI models for white sturgeon and sculpin are both dependent on water depth. The Comprehensive ERA TM should describe how seasonal changes in Willamette River water levels will be considered in the HSI models.

Page 45, Section 4.3.5: It should be noted here that wildlife exposure to surface water was deemed minor and insignificant.

Page 46, Section 4.3.5.2: The foraging depth of 0.5 m based on hooded mergansers habitat use should be expanded to include greater depth. It is likely that hooded mergansers, as well as other merganser species, capture fish a greater depth. Mergansers were selected to represent other diving, fish-eating species such as diving ducks and cormorants, so a depth of 5 to 10 meters would be more appropriate.

Page 48, Section 5.0: The approach for deriving water toxicity values for benthic invertebrates, fish, and amphibians and reptiles is presented as first looking at a federal chronic AWQC, and looking at Oregon AWQC only if a federal number is unavailable. Oregon AWQC are currently based on totals, while federal numbers are currently dissolved numbers. In addition, some current AWQC may be lower than federal numbers. At this point, EPA recommends comparing both total and dissolved surface water concentrations to the most conservative applicable AWQC. Other information, such as comparison to natural background, can be used to determine whether any action is necessary to reduce surface water concentrations to acceptable levels.

Page 49, Section 5.0: If no toxicity data are available and no surrogate chemical can be used, an alternative to simply including it as a data gap in the uncertainty section would be to do site specific toxicity testing. Depending on the significance of the COI, this may be an appropriate approach.

Page 49, Section 5.1: If it is determined based on the evaluation described in this section, further evaluation of the risk to aquatic plants should be assessed quantitatively.

Page 56, section 7.0:   The uncertainty analysis should evaluate the uncertainty associated with the sample design. When samples are not collected randomly, it is not possible to know how data will be biased (e.g., is the result less conservative or more conservative?). Intentional bias in the sample design (e.g., selecting samples only from the most contaminated sites) can minimize this uncertainty because the bias was set up in the sample design.

Page 56, section 7.1, and section 7.3:   Uncertainties associated with the problem formulation and risk characterization include insufficient characterization of the diet of the key receptors, and insufficient sampling to represent the assemblage of prey eaten by the predators (e.g., all we have is crayfish and clams to represent invertebrates). This uncertainty should be added to these sections.

Page 68 and Table 2-1: EPA acknowledges that secondary stressors may have an effect on ecological receptors with Portland Harbor. However, it is unclear how this information will be used to assess risk to receptors from chemical exposure and whether this evaluation is appropriate as part of the ecological risk assessment for the site.

Figure 4-12, Amphibian Surface Water Exposure Area and Proposed Round 2 Sampling Locations: Figure 4-12 does not depict all the surface water samples that will be used to support the ecological risk assessment. Based on Table 2-2 of the Round 2A Surface Water Sampling Field Sampling Plan, the only surface water samples that will not be used to support the ecological risk assessment are the three transects (W-5, W-11, and W-23) and the three human health samples (W-10), W-14 and W-20). Figure 4-12 should be modified accordingly.